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of Mendota is *D. oregonensis*, while that of Green Lake is *D. minutus*, a species of very different habits. It should be noted, too, that the Diaptomi are especially susceptible to the influences of the environment, and we must expect the different species to have their own peculiarities.

He enumerates eight factors which determine vertical distribution, *viz.*: (1) food, (2) temperature, (3) condition of water in regard to dissolved oxygen and other substances, (4) light, (5) wind, (6) gravity, (7) the age of members of any given species, (8) specific peculiarities.

Of these factors, the third is one of great importance, which has received very little attention from preceding authors. Professor Birge states that he is unable to state whether the lack of life in the lower waters of Mendota is due to a lack of oxygen or to a large amount of the products of decomposition. It has seemed to the reviewer that it was very probable that the products of decomposition have very much to do with the lack of life in many lakes, for, in an examination of a number of the Wisconsin lakes during the last summer, it was noticed that the deep lakes of small area had a large amount of organic matter on the bottom and almost an entire lack of animal life, while in the larger lakes with less organic matter there was a considerable abundance of animals. The other factors are discussed with considerable fullness. It is shown that gravity has a marked influence on the vertical position of crustacea, as it is only by considerable effort that they maintain their vertical position, and that, as they grow old or are enfeebled for any cause, they gradually fall to lower levels. Under seven it is shown that the young crustacea appear in greater numbers near the surface. The young of the copepods form an exception, however, for they appear in the greatest numbers near the thermocline.

In conclusion, the reviewer must again express his regret that it is impossible to do justice to the paper within the limits of ordinary review, and considers that he has done as well as could be expected if he has succeeded in making evident the value of the investigation.

BOTANY.

Lessons with Plants.[1]— In recent years there has been a great multiplication of books designed to render the study of botany attractive to the general reader. Albeit some of these have contained a good many questionable statements, they have all ministered more or less directly to an increasing popular demand for simple, non-technical presentations of scientific themes. During the same time there have been many attempts to prepare text-books of botany for common schools and grammar and high schools, the aim of each being to combine simplicity with exactness of statement. Some of these books have been very good, but none of them have occupied quite the field of the one before us.

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[1] *Lessons with Plants: Suggestions for Seeing and Interpreting Some of the Common Forms of Vegetation.* By L. H. Bailey. With delineations from nature

This book occupies a sort of middle ground. It is not strictly a botany, at least not in the old technical sense, but rather a delightful book about plants, — a series of nature studies designed to interest all sorts of people, old and young, teachers, preachers, laymen, and students. Mothers who wish to teach their children something about plants and do not know how to begin will find this book very useful. The same may be said of a large class of teachers in our public schools. At the same time, it will prove a pleasant companion for persons who are neither parents, teachers, nor botanists, but who have a leisure hour now and then for rambles and wish to know something about the plants they meet.

The first sentence of the introduction sets the pace for the whole book: "Plants are among the most informal of objects, but botany is popularly understood to be one of the most formal of the natural sciences. This is only another way of saying that plant study is not always taught by a natural method."

The book is exceedingly attractive in appearance and a perusal of its contents in no way lessens the first impression. It is interesting from beginning to end, even to a professional botanist, who might be pardoned some weariness over details of things long familiar. The aim of the book is to cultivate the reader's faculty for observation and his ability to reason correctly on what he has seen. Some of its suggestive statements will bear quotation: "The lesson to be derived from this discussion is not what particular interpretation has been placed upon certain facts, but that there is endless variety, and that every fact and phenomenon must be investigated for itself." Again: "In making such studies as those recommended in the last paragraph, both teacher and pupil should consider that mere identification is not the end to be sought. It is always a satisfaction to know the names

by W. S. Holdsworth, Assistant Professor of Drawing in the Agricultural College of Michigan. Macmillan, New York, 1898. xxxi + 491 pp., with 446 illustrations.

of plants, but the important results, from the educational point of view, are the awakening of sympathy with natural objects, the sharpening of the powers of observation, and the strengthening of the faculty of reasoning from the object to laws and principles." And once more: "The collecting of natural objects is one of the delights of youth. Its interest lies not only in the securing of the objects themselves, but it appeals to the desire for adventure and exploration. Botanizing should be encouraged; yet there are cautions to be observed. The herbarium should be a means, not an end. To have collected and mounted a hundred plants is no merit; but to have collected ten plants which represent some theme or problem is eminently useful. Schools usually require that the pupils make an herbarium of a given number of specimens, but this is scarcely worth the effort. Let the teacher set each collector a problem. One pupil may make an herbarium representing all the plants of a given swale, or fence-row, or garden; another may endeavor to show all the forms or variations of the dandelion, pigweed, apple tree, timothy, or red clover; another may collect all the plants on his father's farm, or all the weeds in a given field; another may present an herbarium showing all the forest trees or all the kinds of fruit trees of the neighborhood, and so on."

The style of the book is very clear and often remarkably vivid. Occasionally a whole landscape is crowded into a line or two, as in the following: "Most persons are familiar with the flowering dogwood, the small twisted-grained tree which hangs its pink-white sprays against the woodlands in early spring."

All of the illustrations are original, many are excellent, and some are very unique and attractive, *e.g.*, the group of dandelions, the mayflower, the hepaticas, the turnip field showing "a battle for life." The book has a full table of contents, a register of illustrations (to which most of the Latin names are relegated), a glossary, and a good index. The body of the work is divided into parts, chapters, and numbered paragraphs, so as to make it very convenient for use. The introduction tells how the book may be used and how it came to be written. The first part of the text proper is devoted to studies of twigs and buds. This is followed by studies of leaves and foliage, studies of flowers, studies of fructification, studies of the propagation of plants, studies of the behavior and habits of plants, studies of the kinds of plants, and an appendix containing suggestions and reviews. It is not forgotten that country schoolhouses are usually forlorn places, and some pages and several pictures are devoted to showing how the grounds may be made more attractive at slight expense.

Throughout the book the fact is kept constantly before the mind that plants are not fixed and unchangeable objects, but very plastic, gradually changing with changing conditions. Perhaps no text-book ever written is more successful in this respect. "The present forms of vegetation, then, are the tips of the branches of the tree of life. Therefore, the 'missing links' are to be sought behind, not between: they are ancestors, not intermediates." Again: "We really cannot understand plants by interpreting them solely upon their present or obvious characters; the reasons for the appearing of given attributes should be sought in the genealogy, not in the present-time characteristics. It is possible that many of these structures which seem to us to have arisen for the purpose of dispersing the seeds may have originated as incidental or correlative structures, and that it merely so happens that they serve a special but incidental purpose in disseminating the plant. If we once assume that every feature of a plant is adapted to some specific purpose, and that it has arisen by means of the effort of the plant to adapt itself to such purpose, we are apt to find adaptations where there are none. We are really throwing our own thoughts and feelings into the phenomena; and we are developing a superficial method of looking at nature."

Occasionally one notices such slips as are inseparable from first editions, but the errors are remarkably few and of such a nature as to admit of easy correction in the next edition, which we understand is already in preparation. Undoubtedly, the book will open the eyes of a great many people to the delights of meadows and woodlands, and also to the many interesting things that may be found even in a window garden or in the smallest dooryard. It deserves to have a very wide reading, and it is not too much to wish that it might find its way into the hands of a majority of the teachers in our common schools.

ERWIN F. SMITH.

Morphology and Development of Astasia asterospora and Bacillus tumescens. — In recent years several well-known writers, like Bütschli, Fischer, and Migula, have given us their views on the bacterium cell. Since these writers do not agree as to the structure and nature of all the parts, Arthur Meyer[1] has made a careful study

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[1] *Studien über die Morphologie und Entwickelungsgeschichte der Bacterien, ausgeführt an Astasia asterospora A. M. und Bacillus tumescens Zopf.* Flora, **84**: pp. 186–248, pl. 6.